The Middle Triassic Megafossil Flora of the Basin Creek Formation, Nymboida Coal Measures, New South Wales, Australia. Part 9. The Genera *Heidiphyllum, Voltziopsis, Rissikia* and affiliated cones, and ?*Yabeiella.*

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Leaves from the coniferophyte genera *Heidiphyllum, Voltziopsis* and *Rissikia* with its associated fertile cones *Rissikistrobus* (female) and *Rissikianthus* (male) and simple leaves provisionally placed in *Yabiella brachesbuschiana* are described from two quarries in the Middle Triassic Nymboida Coal Measures of the Nymboida sub-Basin in northern New South Wales, Australia. Leaves of *Heidiphyllum* and *Rissikia* form monotypic assemblages on certain bedding planes and are amongst the most common fossils found at Nymboida.

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INTRODUCTION

This is the ninth paper of a series describing the early-middle Triassic Nymboida flora. Part 1 of this series (Holmes 2000) described the Bryophyta and Sphenophyta; Part 2 (Holmes 2001) the Filicophyta; Part 3 (Holmes 2003) fern-like foliage; Part 4 (Holmes and Anderson 2005a) the genus *Dicroidium* and its fertile organs *Umkomasia* and *Pteruchus*; Part 5 (Holmes and Anderson 2005b) the genera *Lepidopteris, Kurtziana, Rochipteris* and *Walkomiopteris*; Part 6 (Holmes and Anderson 2007) the Ginkgophyta; Part 7 (Holmes and Anderson 2008) the Cycadophyta; Part 8 (Holmes et al. 2010) the genera *Nillsonia, Taeniopteris, Linguifolium* and *Gontriglossa* together with the enigmatic lobed leaf *Scoresbya carsburgii*. In this paper the coniferophyte vegetative genera *Heidiphyllum, Voltziopsis* and *Rissikia* together with its affiliated fertile cones (strobili) *Rissikistrobus* (female) and *Rissikianthus* (male) are described. Also included are a cluster of incomplete leaves attributed to the genus *Yabeiella* which occur on a slab with other leaves and dispersed male cones.

A description of the Coal Mine and Reserve Quarries, the source localities of our described material together with a summary of the geology of the Basin Creek Formation, the Nymboida Coal Measures and the Nymboida Sub-Basin were provided in Holmes (2000).

METHODS

The material described in this paper is based mainly on collections made over a period of forty years by the senior author and his family from two then-active Nymboida quarries (Coal Mine Quarry and Reserve Quarry; abbreviated below as CM and RES respectively). The specimens noted in Flint and Gould (1975), Retallack (1977) and Retallack et al (1977) were examined in the collections of

the Australian Museum, Sydney, the Department of Geology and Geophysics of the University of New England, Armidale and the Queensland Museum, Brisbane.

SYSTEMATIC PALAEOBOTANY

The classification follows that used by Anderson et al (2007) for all higher groups from Class to Family. As mentioned in previous Nymboida papers (Holmes et al 2010) cuticles are not preserved. However in most specimens the preservation of gross morphology is excellent.

Class PINOPSIDA Burnett 1835

Family *Voltziaceae* Arnold 1947

Genus *Heidiphyllum* Retallack 1981

Type species

Heidiphyllum elongatum (Morris 1845) Retallack 1981

***Heidiphyllum elongatum* (Morris 1845) Retallack 1981**

Figures 1A–E, 2A, 3A

Selected references

1845 *Zeugophyllites elongatus,* Morris fig. 6(5)
1958 *Phoenicopsis elongatus,* de Jersey p. 84
1965 *Phoenicopsis elongatus*, Hill et al. Pl.T 9(1)
1975 *Phoenicopsis elongatus,* Flint and Gould Pl. 2, fig. 6b
1977 *Phoenicopsis elongatus,* Retallack et al fig. 10A
1978 *Podozamites elongatus*, Anderson Pl. 1, 6–9
1981 *Heidiphyllum elongatum,* Retallack p182, fig.6B
1982 *Phoenicopsis ?elongatus,* Holmes, fig. 11D
1989 *Heidiphyllum elongatum,* Anderson and Anderson p.432, Pls 249–263
2000 *Heidiphyllum elongatum,* Troncoso et al. pp 121–122, figs 3A,B, 3 E–G
2003 *Heidiphyllum elongatum,* Anderson and Anderson pp 90–91

Description

Leaves individually dehisced; simple, linear, elliptic or oblanceolate; length and width variable within assemblages; from 100mm to 200mm, average c. 160 mm in length; from 10mm to 30 mm, average c. 15 mm in width; base narrow to broadly sessile, apex rounded to broad acute; veins dividing near the base then straight and parallel throughout the lamina (c. 10 per 10 mm) and conjoining close to the apex.

Material

AMF137589 (and counterpart) CM; AMF137590 RES; AMF137591 RES; AMF137592 RES; AMF137593 CM.

Discussion

The genus *Heidiphyllum* was erected by Retallack (1981) for simple Gondwana leaves previously placed in the genera *Phoenicopsis* or *Podozamites* on the basis of their close association with the distinct female strobilus *Telemachus* (Anderson 1978). Anatomically preserved leaves described from Antarctica under *Notophytum krauselii* (Axsmith et al 1988b) are probably the permineralised equivalent of *Heidiphyllum.* Compared with the four species described and illustrated in Anderson and Anderson (1989) the Nymboida leaves (Figs 1–3) clearly belong in *H. elongatum*.

Within assemblages the leaves in the Nymboida collection are somewhat variable in length and width. We consider they all belong to a single species complex that is distinguished by its parallel venation and the presence of inter-veinal striae. However this latter feature may not be obvious due to varying forms of preservation. These inter-veinal striae are clearly evident in cuticular studies of the South African Molteno material (Anderson and Anderson 1989, Pl. 252). They are not to be confused with leaf mining (Anderson and Anderson 1989, Pl. 254) which is common in *Heidiphyllum* leaves in the Molteno and was first recorded from the Ipswich C.M. (Rozefelds 1985). At Nymboida distal linear fragments of *Sphenobaiera* leaves may be confused with *Heidiphyllum* but can be separated by their clearly etched veins and the lack of inter-veinal striae.

Specimens of *Heidiphyllum elongatum* account for c. 1% of the Nymboida catalogued collection. On certain bedding planes their massed leaves form monotypic assemblages (Figs 2, 3). During working operations at the Reserve Quarry one such bedding plane of over 300 square metres was exposed. However individual leaves often occur in mixed assemblages (Figs 7D, 8D). Monotypic occurrences of *H. elongatum* are recorded from the Molteno Formation of South Africa (Anderson and Anderson 1989, Cairncross et al 1995) and are considered by those authors to indicate growth in areas of high water table in the floodplain or on channel sandbars. Retallack *et al* (1977) concluded for the Nymboida

Colliery locality that *H. elongatum* occurred as the dominant plant in levee and point bar scrub or woodland. Such a monotypic mass of *H. elongatum* leaves may also be suggestive of an Autumnal leaf fall. Bomfleur et al (2011a) regarded *Heidiphyllum* as 'seasonally deciduous'. Anderson and Anderson (2003) wrote 'whether *Heidiphyllum* leaves were deciduous or evergreen is unknown but we regard them as having probably been evergreen'.

Based on Molteno specimens bearing attached leaves, Anderson and Anderson (2003) envisaged *H. elongatum* in life as an erect woody shrub to small tree bearing leaves in dense pseudo-whorls on short shoots. From their Antarctic material Bomfleur et al (2011a) suggest that it is a 15–20 m forest tree and note that 'the largest axes known exceed 20 cm in diameter'. Both reconstructions could be valid with young trees colonising the water's edge and floodplain and then mature trees becoming forests on drier ground as water courses and tables change over time.

The female and male organs *Telemachus* and *Odyssianthus* respectively that are affiliated with *Heidiphyllum elongatum* in the Molteno of southern Africa (Anderson 1978, Anderson and Anderson 2003) have not been recorded from Nymboida or other Australian localities despite the prevalence of preserved leaves. The female cone *Telemachus* associated with *Heidiphyllum* has also been described from New Zealand (Retallack 1981), South America (Spalletti et al 1991) and Antarctica (Axsmith et al 1998a). However the male cone *Odyssianthus* has been recorded only from the type locality, Telemachus Spruit (Tel 111) which is also the type locality for the female cone. Based on their Antarctic collection from Mt Falla locality Bomfleur et al (2011a) suggest that *Switzianthus* is the male cone of *Heidiphyllum* rather than *Dejerseya* which is also common at the site. In the Molteno of southern Africa *Switzianthus* (Anderson and Anderson 2003) was affiliated with the leaf *Dejerseya* based on closely similar cuticles and their mutual occurrence at two localities (with a possible third). In the Ipswich Coal Measures at Dinmore *Dejerseya* was found as a monodominant leaf on some bedding planes together with numerous *Switzianthus* and a possible *Matatiella* megasporophyll (Anderson and Anderson 2003). The affiliation of organs will always be uncertain short of finding direct attachment. In another paper Bomfleur et al (2011b) reconstructed *Dejerseya* as having the pollen organ *Townrovia* based on slim evidence (a single specimen with uncertain generic identification) and no reference was made to the *Switzianthus* affiliations described from other localities in Gondwana. Another puzzle is the apparent affiliation of *Heidiphyllum* with the cone *Dordrectites* bearing T-shaped ovulate scales at numerous Molteno localities. This affiliation is also recorded by Anderson and Anderson (2003, p. 63) from the Moolayember Formation, Australia and in the Los Rastros Formation of South America. A single specimen of *Dordrectites* sp. was found at Nymboida by us (23.5.2002) associated with *Heidiphyllum* leaves but unfortunately the specimen has subsequently been misplaced.

Genus *Voltziopsis* Potonié 1899

Type Species

Voltziopsis africana Seward 1934

Voltziopsis sp. A

Figures 4A–F, 5A–D

Description

Branching foliar shoots; length incomplete, as preserved 80 mm; width c. 7 mm wide; leaves closely spaced on stem, c. 3mm wide and to 7 mm long, attached at c. 30°–45°, concave, thicker near base, ovate with acuminate apex.

Material

AMF137594 and counterpart AMF137595, RES.

Discussion

This taxon is based on one slab and its counterpart showing two foliar shoots (the larger shoot marked 'x' and the smaller 'y') each with a lateral branch (Figs 4A–F, 5A–D). Details of the leaves are illustrated (Fig. 5D) and an arrow indicates the acuminate apex of a leaf.

The coniferophyte genus *Voltziopsis* is known from five species ranging from Upper Permian to Early Triassic (Townrow 1967b, Anderson and Anderson 1989). The species are differentiated essentially on both gross morphological and cuticular features of the foliar shoots and female cones. In the absence of cuticle and cones the Nymboida material is placed with reservation in *Voltziopsis*. Similar sterile material can occur in various families with very specific cones and in the absence of fertile material is often placed in the form genus *Brachyphyllum*, eg. the Nymboida specimens are similar in gross morphology to *B. crucis* (Barbacka et al. 2006, Pl 2, fig. 5). We prefer to place it in *Voltziopsis* as the genus is well documented in Gondwana (Townrow, 1967b; Holmes and Ash 1979, Anderson and Anderson 1989)

and furthermore the Nymboida material is similar to the shoots of *Voltziopsis angusta* (Townrow, 1967b) first described by Walkom (1925) as *Brachyphyllum angustum*.

***?Voltziopsis* sp.**
Figure 5E, F

A small narrow linear fragment of a foliage stem with alternate triangular bract-like leaves c. 1.5 mm long (AMF137622, CM) is illustrated (Figs. 5E, F) but is too poorly preserved to allow closer identification and is referred to ?*Voltziopsis* sp.

Family Podocarpaceae Endlicher 1847

Genus *Rissikia* Townrow 1967a

Type species
Rissikia media (Tenison Woods 1883) Townrow 1967a

***Rissikia media* (Tenison Woods 1883) Townrow 1967a**
Figures 6A–G, 7A–D, 8A–D

Selected references
1883 *Taxites medius,* Tenison-Woods Pl. 9(3)
1965 *Elatocladus* sp., Hill et al. Pl. T 8 (7)
1967a *Rissikia media,* Townrow; fig.1E–I
1975 *Rissikia media,* Flint and Gould fig. 6a
1977 *Rissikia media,* Retallack et al. fig. 10F
1982 *Rissikia media,* Holmes, fig. 11E
1989 *Rissikia media*, Anderson and Anderson, p. 453, Pls 265–273
2000 *Rissikia media*, Troncoso et al. p.122, fig 3D
2003 *Rissikia media*, Anderson and Anderson, p. 113

Description
Foliage shoot, narrow to broadly elliptical from 70–100 mm average c. 85 mm in length and from 20–50 mm average c. 25 mm in width; leaflets from 20 to 65 average c. 45, helically attached from 45° to 80° to rachis but appearing pinnate as preserved; linear to linear elliptic; single median vein.

Material
AMF137596 CM; AMF137597 RES; AMF137598 CM; AMF137599 RES; AMF137600 RES; AMF137601 RES; AMF137602 RES; AMF137603 CM; AMF137604 CM; AMF137605 CM; AMF137606 CM; AMF137607 CM; AMF137619 RES.

Discussion
While the individual leaves at Nymboida show some variation in length, width and density of the leaflets, we regard them all as forming a single species complex (Figs 6, 7). Leaflet attachment varies from fairly closely spaced (Fig. 6D) to more widely spaced (Fig. 6C). Absent from our collections are the narrow shoots with shortened leaflets that occur in some Molteno assemblages (e.g. Umk111 and Hla213) and were described as *R. apiculata* by Townrow (1967a). Based on their extensive collections Anderson and Anderson (1989) showed that *R. media* and *R. apiculata* formed a continuous range of variation and synonymised the latter forms with *R. media.* Occasional leaves from Nymboida with more closely spaced and broader leaflets approach *R. eskensis* as described by Webb (1980) from the Esk Formation of Australia and the Molteno Formation of southern Africa by Anderson and Anderson (1989).

At both Nymboida localities foliage shoots of *Rissikia media* are very common and found together with other fossils on the same slabs (Figs 6A–C, 7D). They also occur as massed monotypic assemblages on certain bedding planes (Fig. 8A–C) or in association with *Heidiphyllum elongatum* (Figs 7D, 8D) which suggests autumnal leaf falls from a woodland comprising these two species. From occurrences in the Molteno Retallack and Dilcher (1988) visualised *Rissikia* as a tree in the *Dicroidium odontopteroides* dominated deciduous floodplain woodlands. However at Nymboida *Dicroidium* leaves are absent from autochthonous *Rissikia* leaf assemblages but often occur together in allochthonous deposits (Fig. 6A, B).

We follow Townrow (1967) in the placement of *Rissikia* and its associated female and male cones in the family Podocarpaceae. However this placement is not secure as was discussed in detail by Anderson and Anderson (2003, p. 105) and in the more recent synthesis of the gymnosperms by Anderson et al (2007). While extant members of the Podocarpaceae are evergreen this does not exclude ancient members from being deciduous.

Genus *Rissikistrobus* Anderson and Anderson 2003

Type species
Rissikistrobus plenus Anderson and Anderson 2003

***Rissikistrobus* sp. A**
Figures 9A–C, 10A–G, 11A

Description

Linear female cone, longer than 50 mm, 5 mm wide with bract/scale complexes bearing ovules.

Material

AMF137613 CM; AMF137614 CM; AMF137615 RES; AMF137624 CM; AMF137625a,b RES; AMF137626 CM.

Discussion

Eight specimens of female cone occur in the collection (Figs 9, 10, 11A). Slab AMF137613 bears three individuals (Fig. 9) and shows two longer sections 'x', 'y' and one small portion of cone 'z'. The longest cone 'y' as preserved is 50 mm long and 5 mm wide with basal and distal sections missing. The bract/scale complex are closely spaced and attached at c. 30°–45° to the axis, 2 mm wide and 4 mm long, ovate with acute apex. They appear to show ovules (visible at high magnification with suitable light), mainly in lateral view (a possible one is marked by an arrow in Fig. 9C) but the presence of the diagnostic paired arrangement of the ovule/seed on the cones is not apparent probably due to the high rank coalification of the specimens. The cone AMF137626 (Figs 10D–G) is broken at the upper end and shows a group of *Rissikia* leaflets at a slightly lower level. It is uncertain whether they may belong together or are a chance alignment during preservation. The unusual female cone (Fig. 11A, 't', AMF 137615) occurring close to some male cones of *Rissikianthus* (AMF 137608) shows simple ovuliferous scales and along the distal portion the longer scales look more like leaves. Slab AMF137613 showing three cones closely aligned. (Fig. 9) may be the chance preservation or indicate that these cones occurred on a common axis as is found in some modern genera e.g. *Taxodium mucronatum*. On the same surface occur three clear portions of *Rissikia* leaves and other fragments. The slab is irregular and has no clear bedding plane probably indicating that these fossils were deposited quickly in a high energy environment.

The Nymboida specimens are placed in *Rissikistrobus* with confidence. However, from the absence of specific characters in the bract/scale complex due to the high rank coalification of the cones they are here referred to as *Rissikistrobus* sp. The small portion of a cone as drawn by Retallack et al (1977) shows pairs of ovules but the ovuliferous scales are not clear enough to determine the species. These specimens and the one mentioned above from Cloughers Creek Fm., also in the Nymboida C.M. are the only other records of *Rissikistrobus* in the Gondwana Triassic apart from the Molteno, southern Africa where three species are described from seven localities with a total of 85 individuals by Anderson and Anderson (2003).

A female cone possibly similar to *Rissikistrobus* was described from the Jurassic Nambour Basin (Loc. 4) by Pattimore and Rigby (2005, pl. 78). The material is poorly preserved. However it is associated with male cones and leaves assigned to *Rissikia*.

Genus *Rissikianthus* Anderson and Anderson 2003

Type species

Rissikianthus townrovii Anderson and Anderson 2003

Rissikianthus sp. A

Figures 11A–D, 12A–G, 13A–C, 14A, B

Description

Ovate male cone 7–15 mm long, 5–7 mm wide; microsporophyll triangular, c. 1.5 mm in width, with acuminate apex.

Material

AMF137608, RES; AMF137610 RES; AMF137611 and counterpart AMF137612 CM; AMF137616 RES; AMF137621 RES.

Discussion

Twelve cones are present in the collections from Nymboida. On three slabs the cones occur in groups with four cones (w, x, y, z) close together on AMF137608 (Fig. 11A.B); three cones (x, y, z) on AMF137611 (Figs 12C–G) and three cones (x, y, z) on AMF137616 (Figs 13A–C,14A, B). On the latter slab are portions (AMF137618) of the cycad *Pseudoctenis nymboidensis* (Holmes and Anderson 2008) and numerous fragmentary leaves (AMF137617) described below as ?*Yabeiella brackebushiana*. The specimens AMF137621 (Figs 11C,D) and AMF137610 (Figs 12A,B) each bear a single *Rissikianthus* cone.

The high rank coalification of the cones has obscured specific details and makes comparison with described species difficult. Microsporangia have not been observed. On a number of cones the microsporophyll is visible in side view (e.g. Fig. 11D, AMF137621) and on AMF137610 it is visible in outer view (Fig. 12B). From the Molteno Flora Anderson and Anderson (2003) have described four species of *Rissikianthus* based on 79 individuals and including some very clearly preserved cones especially from the Peninsula (Pen321) locality. The Nymboida material is closest in gross morphology to the microsporophyll

of *R. concavus* Anderson and Anderson (2003).

Pattemore and Rigby (2005, Pl. 8B,C) described a group of conifer cones attached to a stout stem from the Jurrasic Nambour Basin, Queensland. The cones are very similar superficially to *Rissikianthus* but differ from material described from the Molteno (Anderson and Anderson, 2003, p.110) of cones being attached to a gracile axis.

Class GNETOPSIDA Eichler ex Kirpotenko 1884

Family Fraxinopsiaceae Anderson and Anderson 2003

Genus *Yabeiella* Oishi 1931

?*Yabeiella brackebushiania* (Kurtz 1921) Oishi 1931

Figures 13A–C, 14A, B

Description

Leaves linear, longer than 43 mm, width 4–6 mm, venation fine (25 per 10 mm) forking close to midrib, mostly parallel with occasional anastomoses and faint marginal vein.

Material

AMF137617 RES, numerous incomplete leaves.

Discussion

A cluster of sixteen linear leaf fragments are preserved at various orientations and alignment on a single slab (Figs 13,14). The longest leaf portion preserved (marked as 'w') is 43 mm. The width of the leaves is fairly constant at 4-6 mm. Venation is very fine and sometimes difficult to decipher. There are at least 25 veins per 10 mm and on some leaves seem to be even denser. Each lateral vein divides close to the midrib and then runs straight and parallel at c. 80° towards the margin; sometimes dichotomising again mid way or near the margin. Occasionally the veins appear to coalesce and form areoles. There is a suggestion of a marginal vein on the longest leaf and possibly on some of the other leaves.

On this slab there is a mixed plant assemblage containing three male cones of *Rissikianthus* sp. A and two portions of the cycad leaf (AMF137618) *Pseudoctenis nymboidensis* (Holmes and Anderson 2008) together with numerous linear leaf fragments identified here as ?*Yabeiella brackebushiania*. The presence of the marginal vein is the main character of the genus *Yabeiella* that distinguishes it from leaves in the genus *Taeniopteris*. However, in *Yabeiella* leaves this feature is not always obvious and is only clearly evident in well preserved material. The marginal vein on one of the leaflets from Nymboida (Fig 14A'w') is similar to that preserved in *Yabeiella brackebushiania* from Konings Kroon (Anderson and Anderson 1989, Pl. 280 figs 10, 14). Some of the Molteno leaves have similar fine venation as in the Nymboida material but most leaves have much more widely spaced venation. The width of the Nymboida leaves (4–6 mm) is consistently narrower than the populations of *Yabeiella brackebushiania* from the Molteno (mainly 8–14 mm) and may indicate a separate species. However as the Nymboida leaves are so incomplete we are reluctant to place it in a new species.

Yabeiella is clearly affiliated with the winged seed *Fraxinopsis* in South America (Jain and Delevoryas 1967), Southern Africa (Anderson and Anderson 2003) and Australia (Oishi 1931, Jones and de Jersey 1947). At Nymboida *Fraxinopsis* is as yet unknown.

If one disregards the presence of the indistinct marginal vein then the dense venation of these leaves is similar to certain species in the genus *Taeniopteris*. For example *T. cylomeiformis* Anderson and Anderson (1989, p. 372) has similar dense venation but the veins fork once only. *T. densinervis* Menendez (1951) from Argentina and from Chile (Gnaedinger and Herbst, 2004) has similar dense venation but the leaves are three times as broad as the Nymboida material. The venation of *T. parvilocus* (Anderson and Anderson (1989, p.373) is similar in also forking twice and occasionally anastomosing but the venation is more widely spaced (13/10 mm) and the leaf width is generally much wider (20 mm). The *Taeniopteris* species described from Nymboida (Holmes and Anderson 2010) differ from the above fragmentary leaves by their much larger size and coarse venation. These leaves are thus unlike any known *Taeniopteris* from Gondwana.

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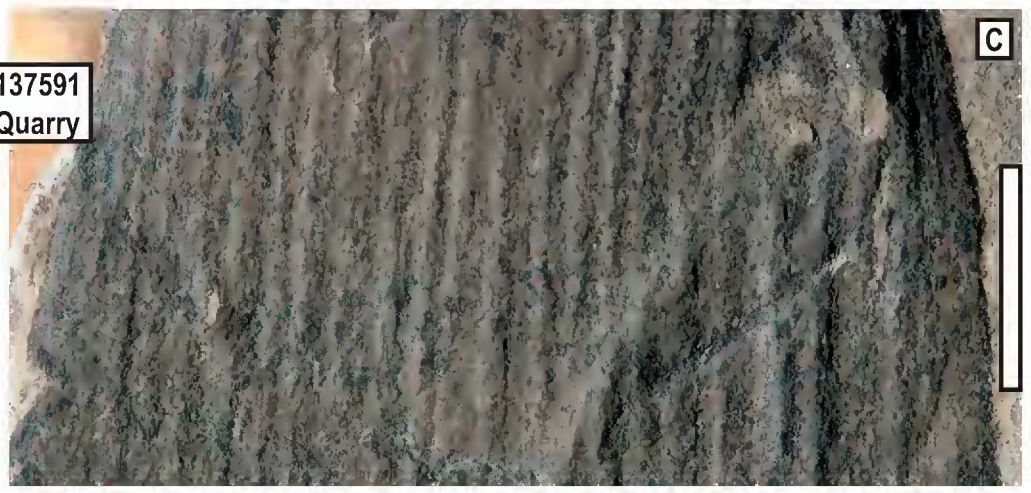

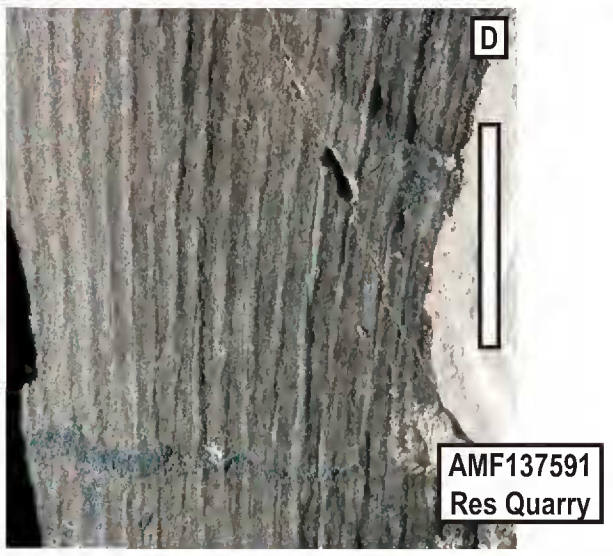

Figure 1. A–E. *Heidiphyllum elongatum* Retallack (scale bar = 10 mm).

Figure 2. A. *Heidiphyllum elongatum* Retallack (scale bar = 50 mm).

Figure 3. A. *Heidiphyllum elongatum* Retallack (scale bar = 10 mm).
AMF 137593. CM Quarry.

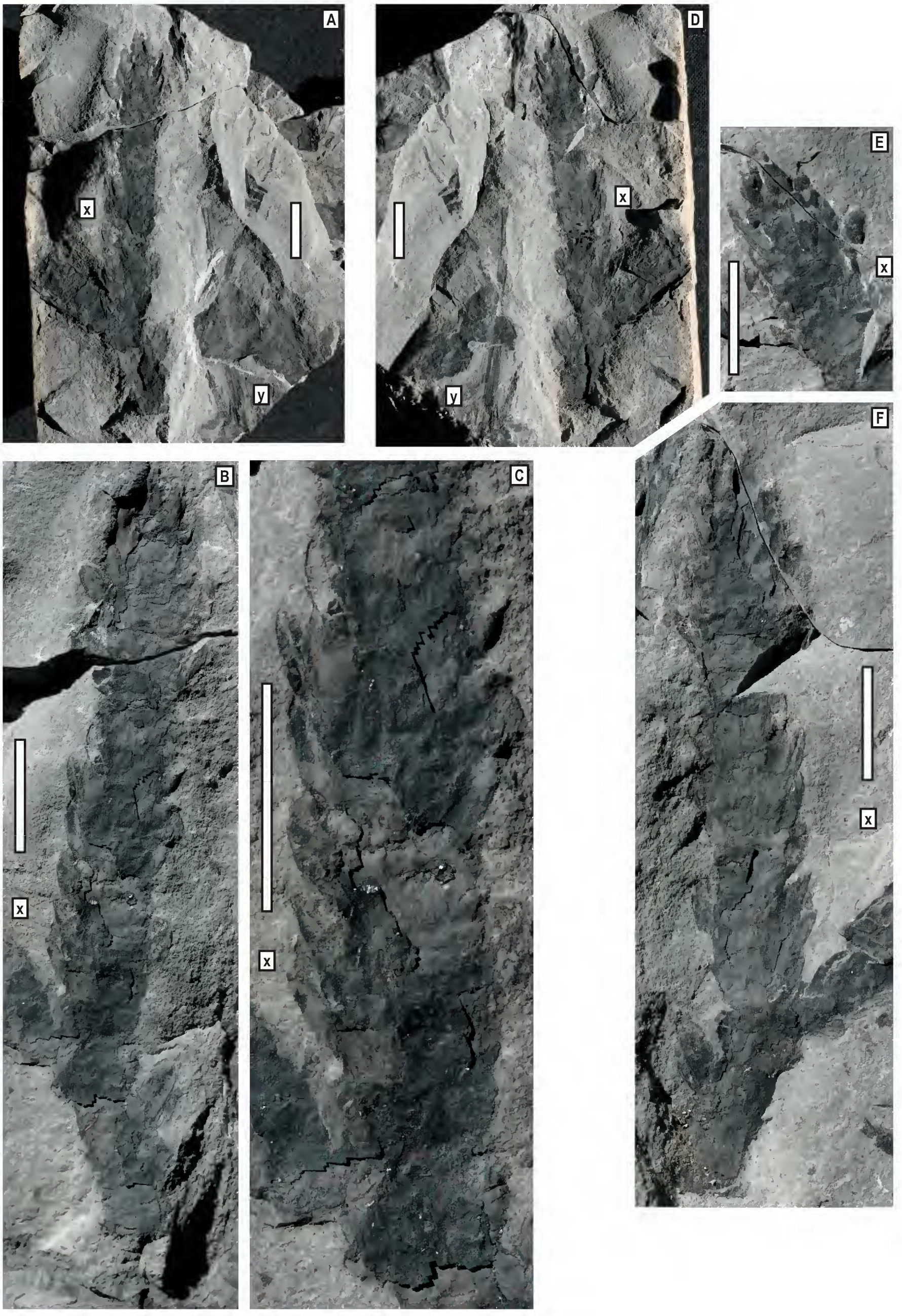

Figure 4. *Voltziopsis* sp. A., A–C AMF137595; D–F AMF137594, Res. Quarry (scale bar = 10 mm).

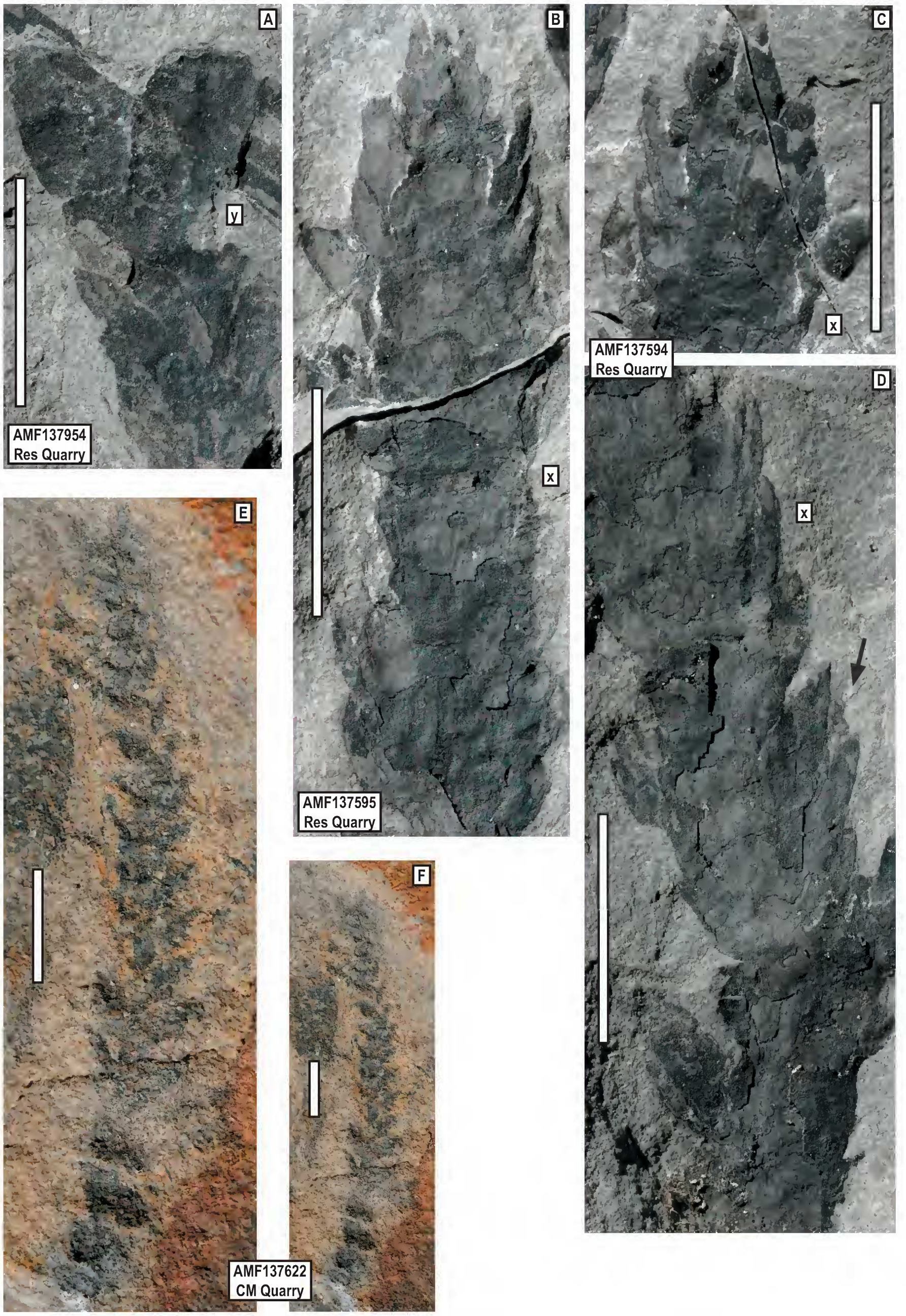

Figure 5. A–D *Voltziopsis* sp. A., E, F ?*Voltziopsis* sp. (scale bar = 10 mm).

Figure 6. A–G *Rissikia media* Townrow (scale = 10 mm).

Figure 7. A–C *Rissikia media*Townrow. D *R. media* and *Heidiphyllum elongatum* Retallack (scale = 10 mm).

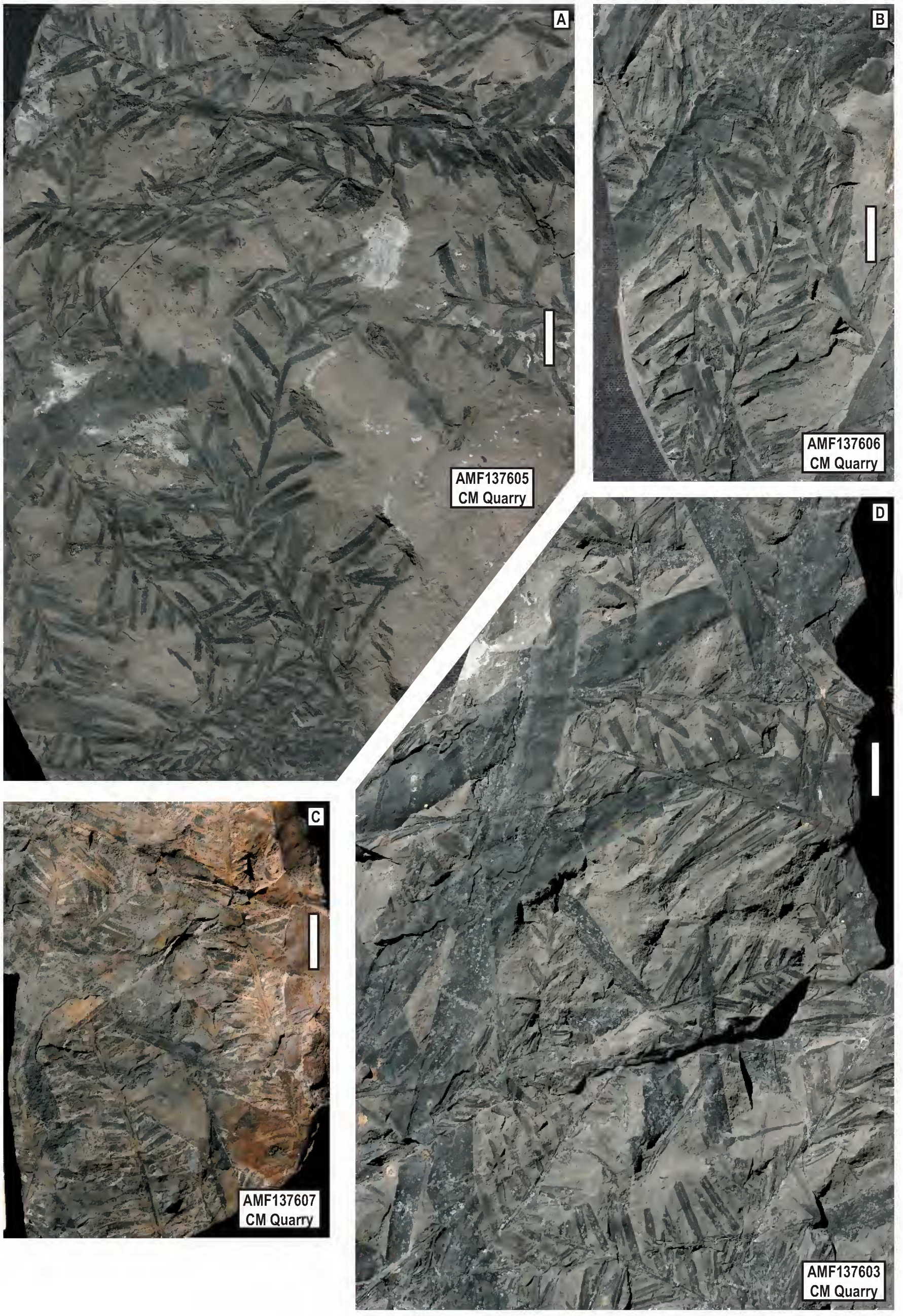

Figure 8. A–D *Rissikia media* Townrow (scale = 10 mm).

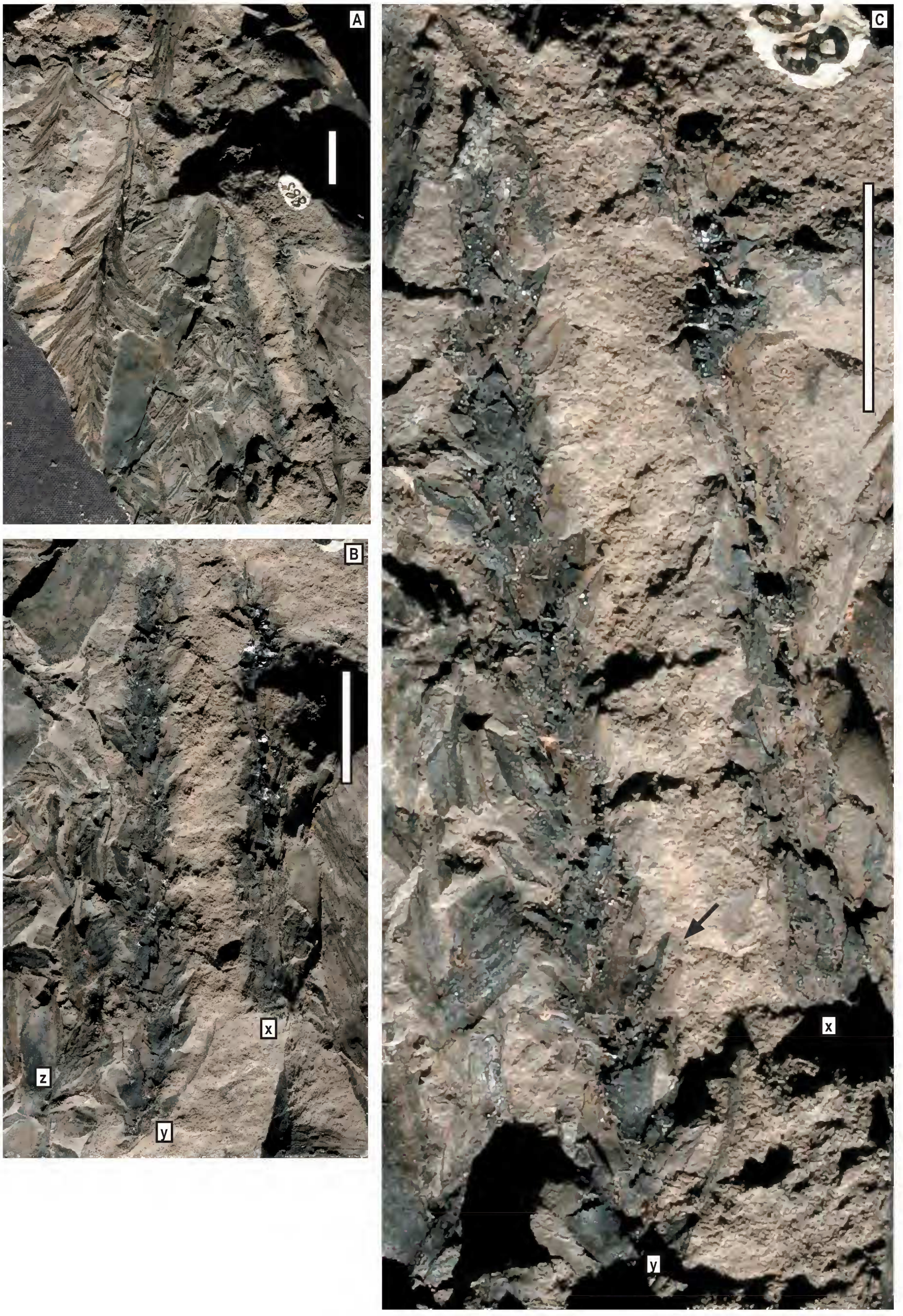

Figure 9. A–C *Rissikistrobus* sp. A (3 cones x, y, z). Arrow shows tips of two scales and an ovule to lower left. AMF 137613, Coal Mine Quarry (scale = 10 mm).

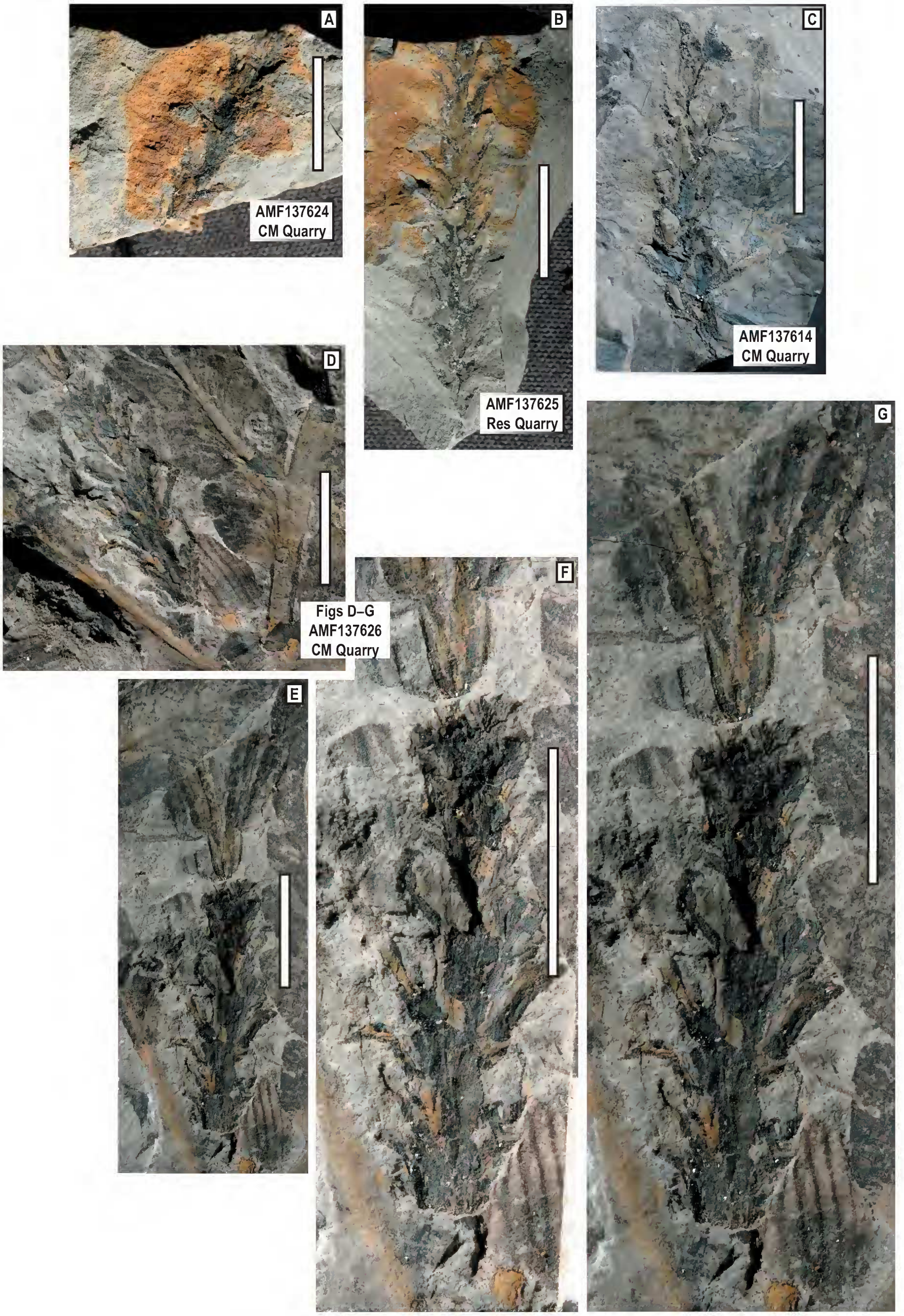

Figure 10. A–G *Rissikistrobus* sp. A (scale = 10 mm).

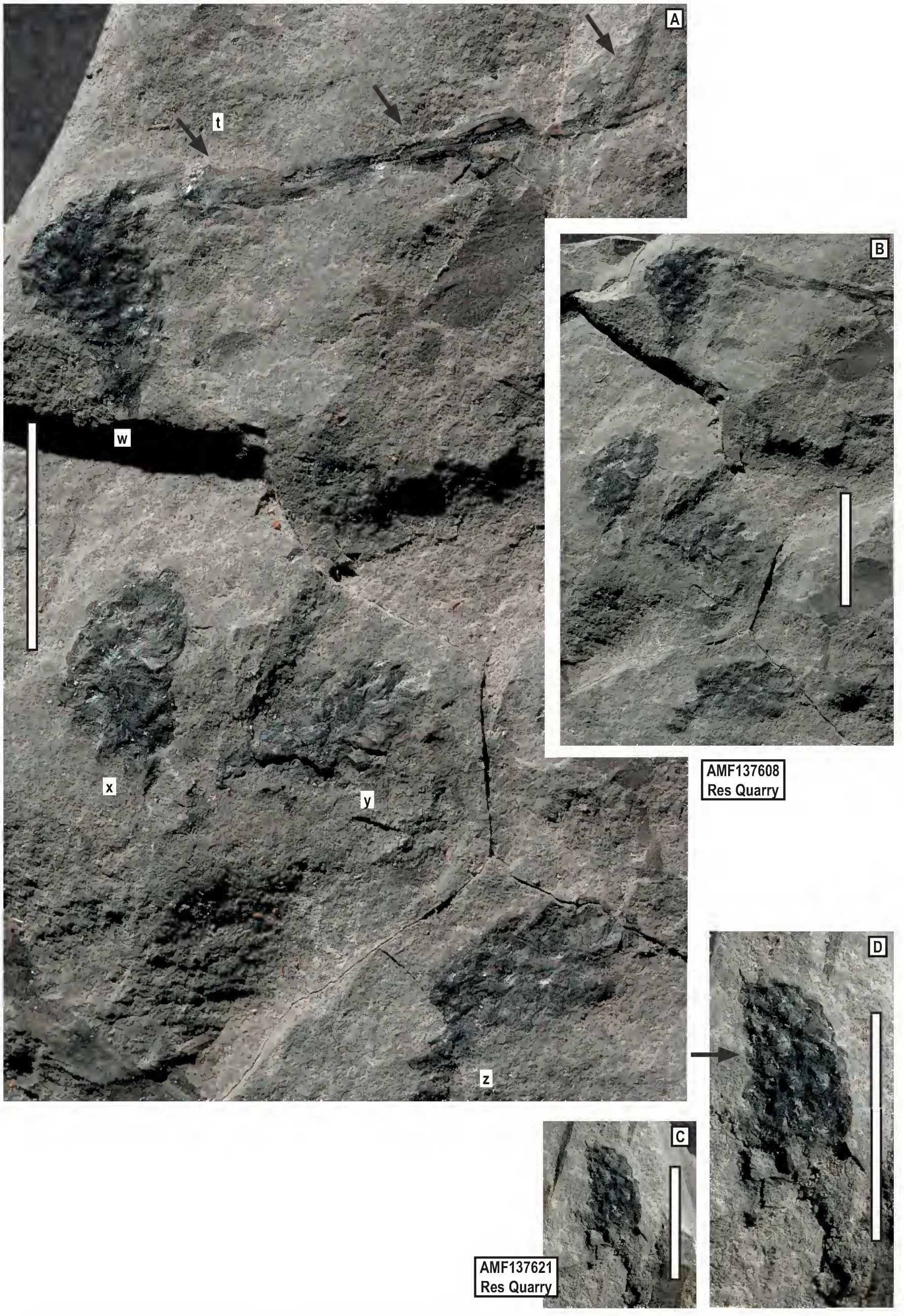

Figure 11. *Rissikianthus* sp. A. A,B has four male cones in close proximity marked as 'w, x, y ,z' AMF 137608 with a female cone marked 't' (see 3 arrows) AMF 137615. C,D a single male cone with a scale in side view (see arrow) (scale = 10 mm).

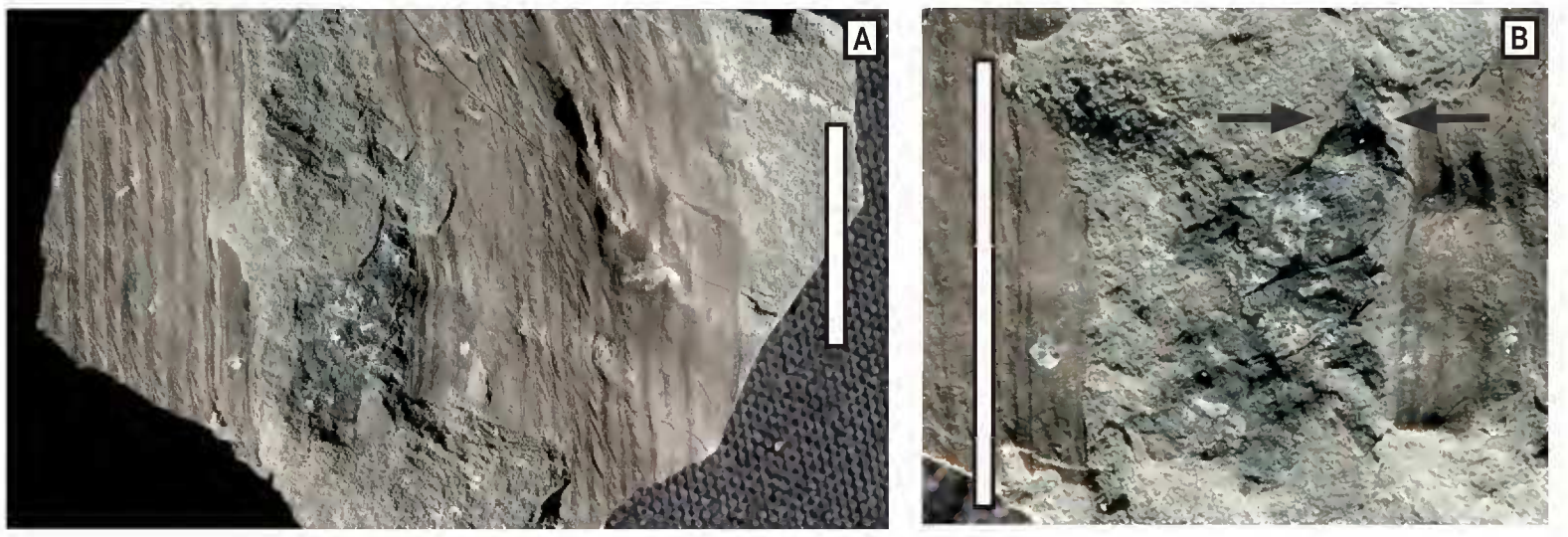

Figure 12. *Rissikianthus* sp. A. A,B Single incomplete cone with a good scale indicated by arrow, Reserve Quarry, AMF 137610; C–G Three cones in close proximity 'x, y, z', Coal Mine Quarry, C,D,F,G AMF 137611, E AMF 137612 (counterpart) (scale = 10 mm).

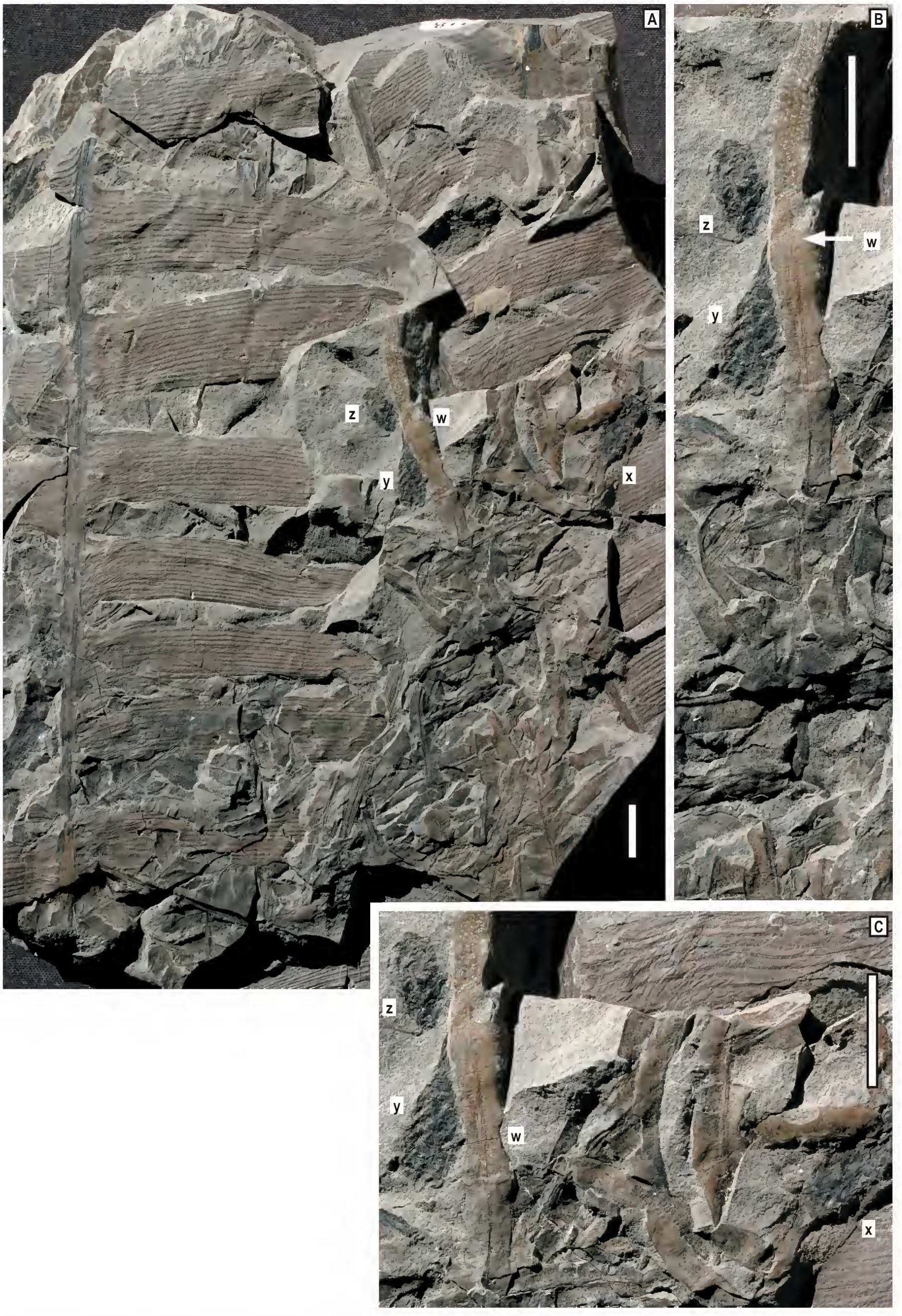

Figure 13. A–C One large slab with: *Rissikianthus* sp. A (3 male cones x, y, z) AMF 137616; ?*Yabeiella brackebushiania* (numerous leaf fragments, longest indicated as w) AMF 137617; *Pseudoctenis nymboidensis* (cycad leaf on LHS) AMF 137618. Reserve Quarry (scale = 10 mm).

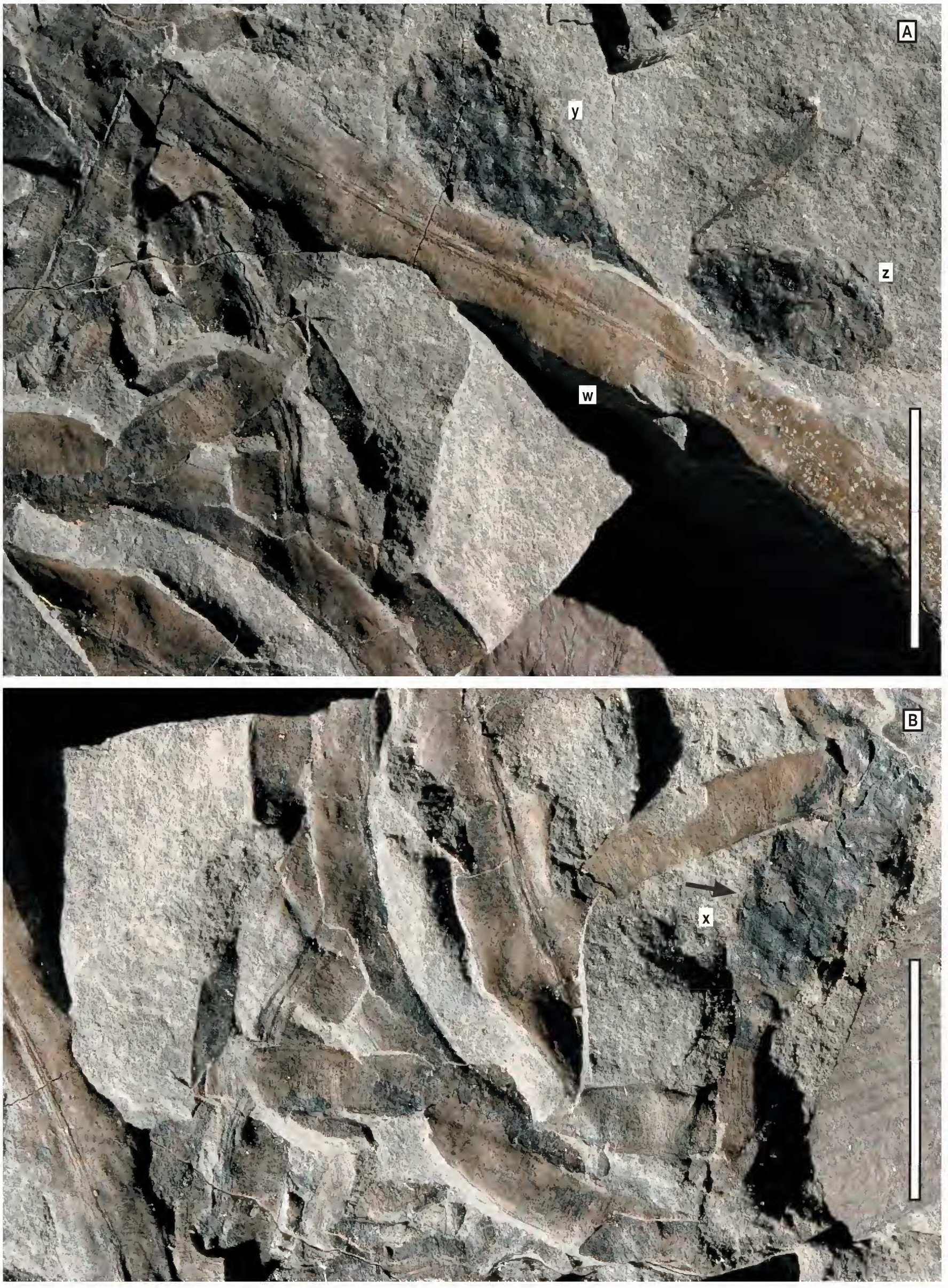

Figure 14. A,B *Rissikianthus* sp. A (3 male cones x, y, z) AMF 137616, ?*Yabeiella brackebushiania* (numerous leaf fragments, longest indicated as w) AMF 137617. Reserve Quarry (scale = 10 mm).